SIS55: Benefit of IoT and Big Data
for Automated driving and User Trust Challenge

SIP-adus: Japanese Automated Driving Project

Hajime Amano

President, ITS Japan
Chairman, International Cooperation WG, SIP-adus

October 31, 2017

Contents

**Cross-Ministerial Strategic Innovation Promotion program
Innovation of Automated Driving for Universal Services**

"SIP- adus"

- Mobility Bringing Everyone a Smile -

Inclusive society, where diverse people in diverse communities actively participate in generating values, will enhance both wellness of individuals and economic development. Automated driving technologies integrated with social innovations should provide everyone with mobility to fully exercise his or her capacity, enabling sustainable development of the society.

Vehicle

HMI

<Recognition> <Judgement> <Operation>

Human Machine Interface

Map, ITS info., Sensor   AI   Actuator

Cooperation w/Human

Important Technologies
・Self-position estimation
・Neighboring environmental recognition

Dynamic Map

Link

ITS Predictive Information

High Definition 3D Map

Onboard Sensors

GNSS

Laser Scanner(LiDAR)

Camera

Radar
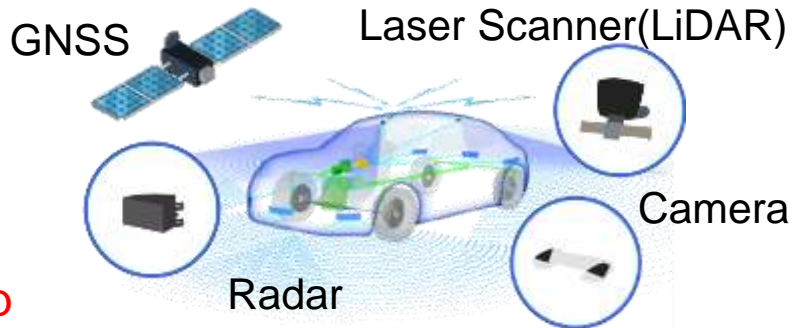
Basic Tech.   Security, Simulation, Database, etc.

In red : Area of Cooperation ⇒ Main Area of SIP-adus

SIP-adus focus on R&D in Cooperative area with Industry, Academia and Government

Dynamic Map

API

OEM

API : Application
Program
Interface

Link

Base

Platform

Dynamic Data

Movement of Vehicles, Status of
Pedestrians, Traffic Signals etc.

Semi-dynamic Data

Accidents, Traffic Jams, Detailed Weather etc.

Semi-static Data

Traffic Regulation, Road Construction,
Weather etc.

Static Data
=**High Definition 3D Map**

Road, Lane, 3D Shape of Structures etc.

Combine
various data

Digital Mapping

3D Common Platform Data

Point Clouds, Graphics, Probe Data etc.

Various
Uses
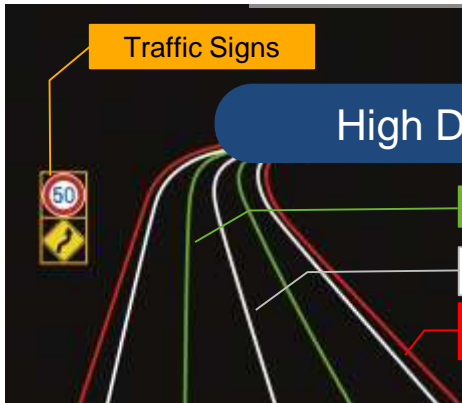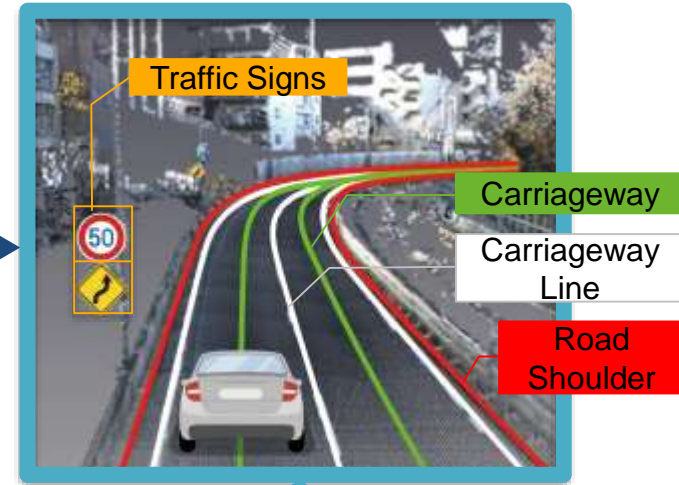
SIP
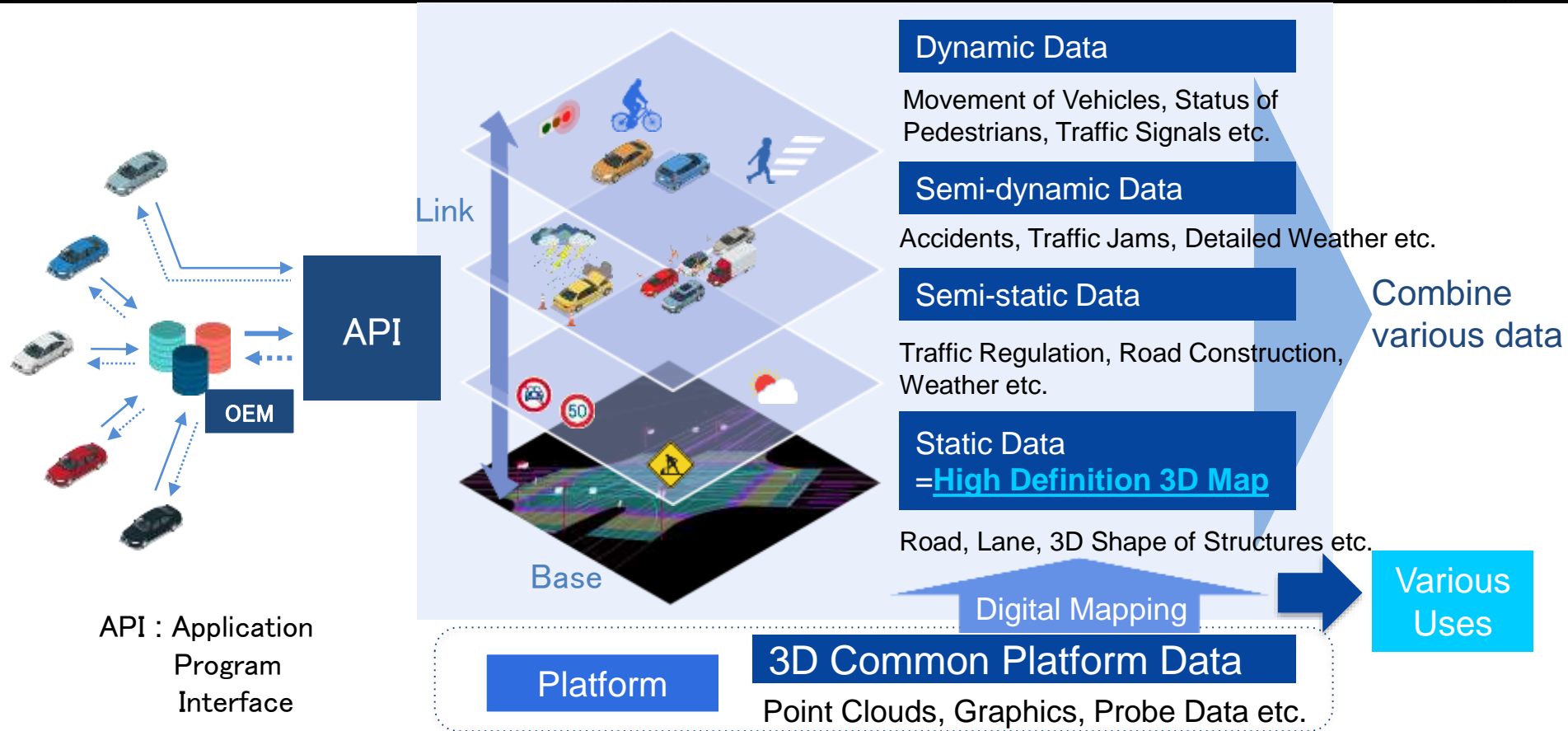
Connected Vehicles (V2I&V2P)

Sensor for Vehicles and Pedestrians

Antenna

Attention

Onboard Display

Mobile Device
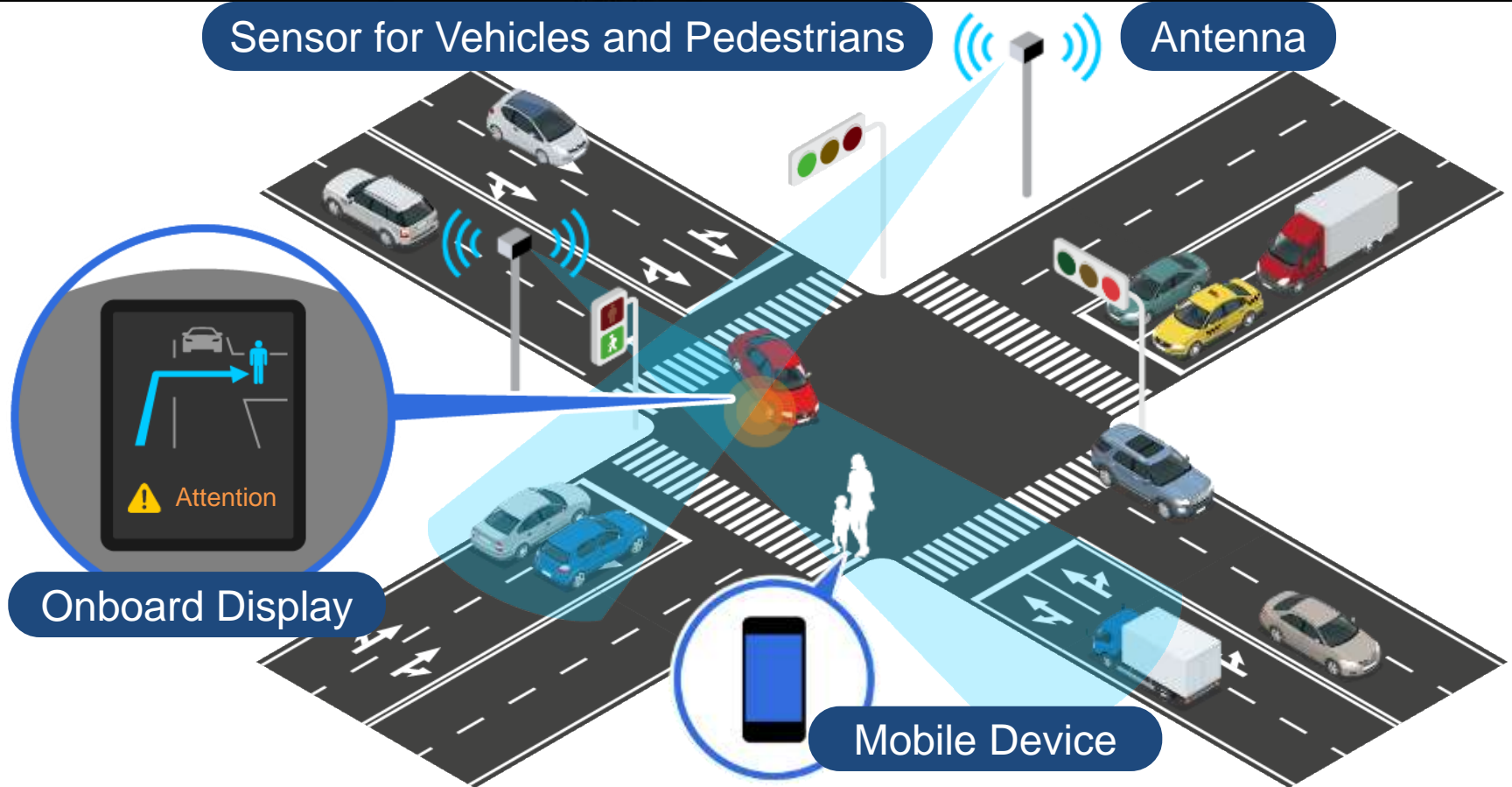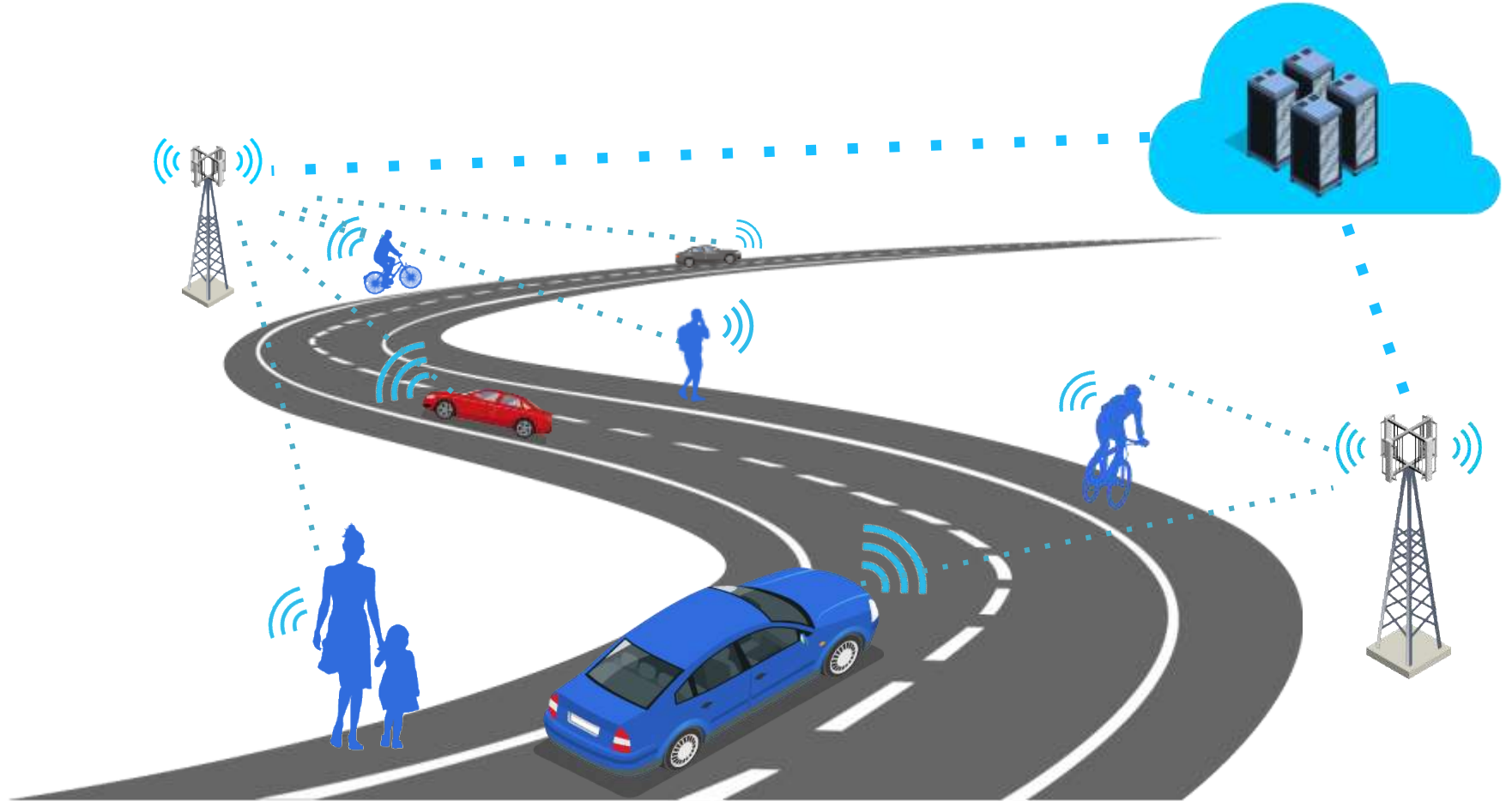
User Friendliness （JAMA）
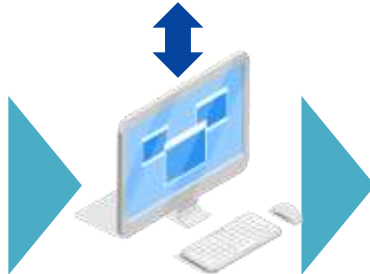
Vulnerability Evaluation

◆Common Architecture Model
◆Use Cases of Automated Driving （JAMA）
◆Thread Info. （JPCERT/CC, Auto-ISAC）
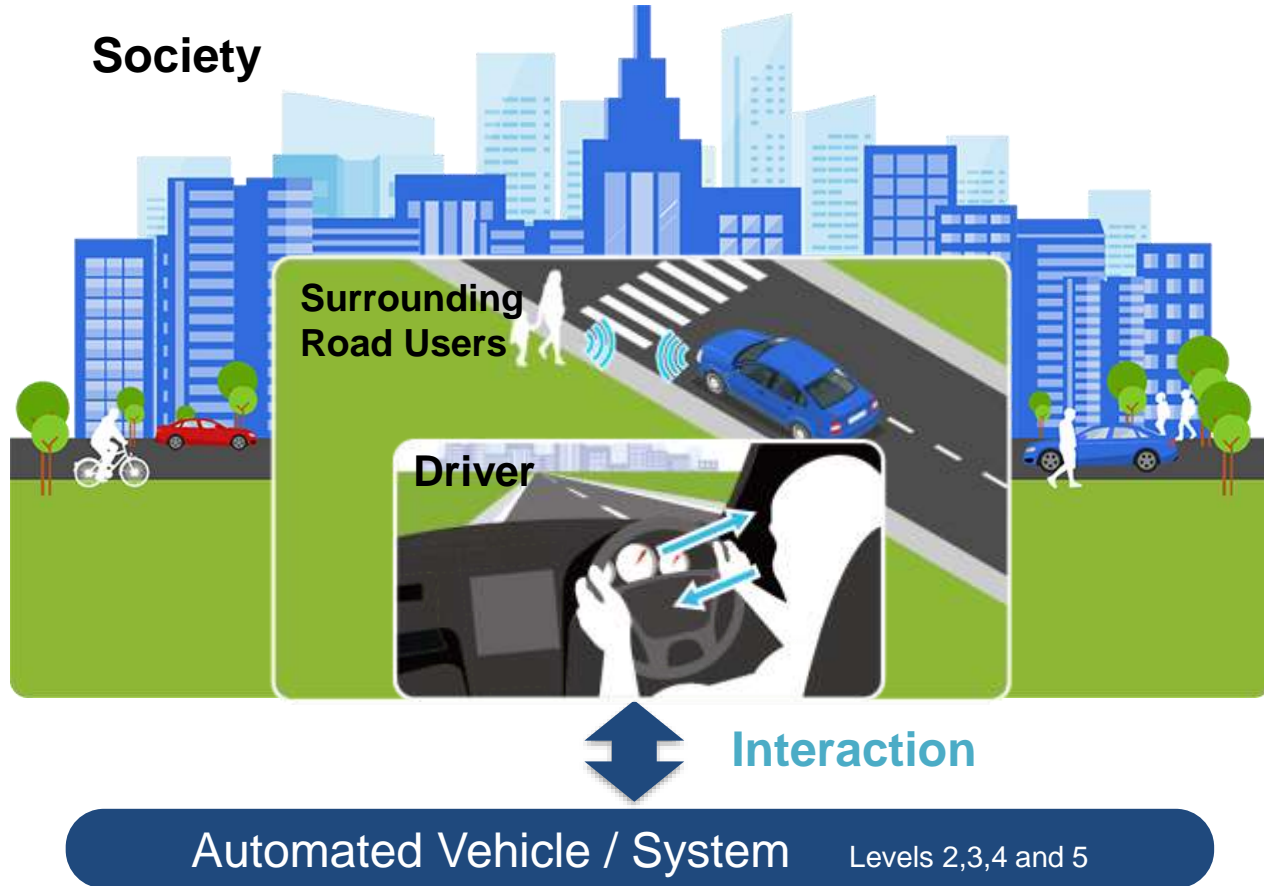◆Evaluation （Attack） Info. （Auto-ISAC）

Threat Analysis Tool

◆Countermeasure
◆Level of Countermeasure

WiFi

Telematics

Comparison with Current Threat Analysis (JasPar）
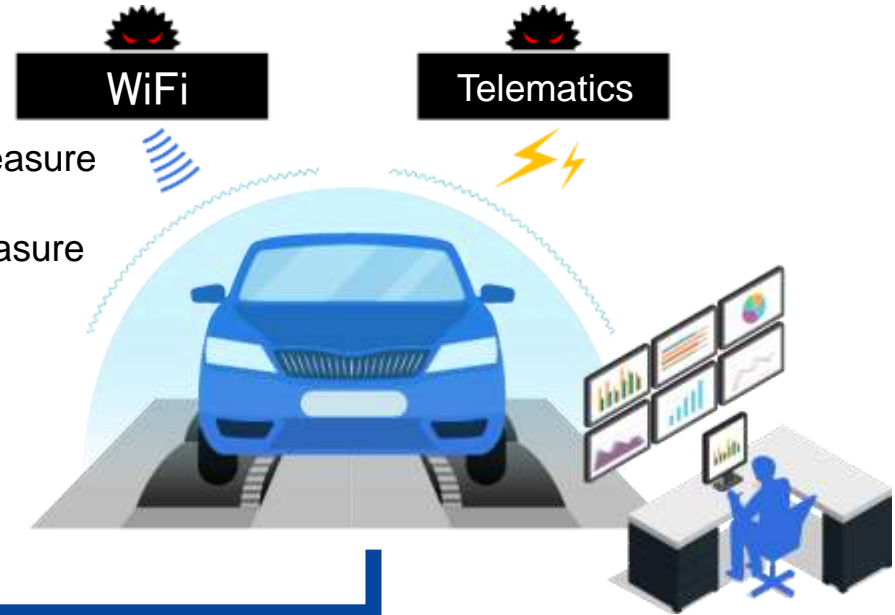
Cyber Security Evaluation Guideline

Society

Surrounding Road Users

Driver

Interaction

Automated Vehicle / System   Levels 2,3,4 and 5

Next Generation Transport

SIP

ART Information Center

Advanced PTPS

Walking Map

Real-time Bus Operation Information

Dynamic Connection Information

Bus Operator

PTPS Roadside Detector

Precise Docking Control

Movement Restrictions Assistance Information

Crowdedness Information

Congestion Prediction

On-demand Navigation

STATION

Dynamic Connection Information

Smooth Acceleration/Deceleration

Impact Assessment ： Accident Reduction

SIP

| Real Traffic Flow Simulation | Traffic Accident Analysis | Effect Prediction |

Traffic accidents reduction simulation "Multi Agents"

Automated Driving Vehicle

Pedestrian

Manual Driving Vehicle

[Simulation Parameters]
- Levels of Automation
- Diffusion of Automated Driving Vehicle
- Error Action(driver/pedestrian)
- Traffic Flow Density
- Number of Pedestrian   etc.

Five major scenarios

| Rear End |
| Lane Departure |
| Pedestrian Crossing |
| Crossing |
| Head-on |

- Collision Warning
- Advanced Emergency Braking
- Lane Departure Warning
- Lane Keeping Assistance

Simulation result

Contributions by ADVs

	W/	W/o
ADV	60%	40%
Man.DV	50%	10%
Ped.	30%	25%
…	…	…

Traffic Accident Reduction

Number of
 -Fatality
 -Severe Injury
 -Slight Injury
 -Near-Accident
 -Traffic Jam Due
  to Accident etc.

Impact Assessment : CO_2 Reduction

Current : Congestion due to speed change

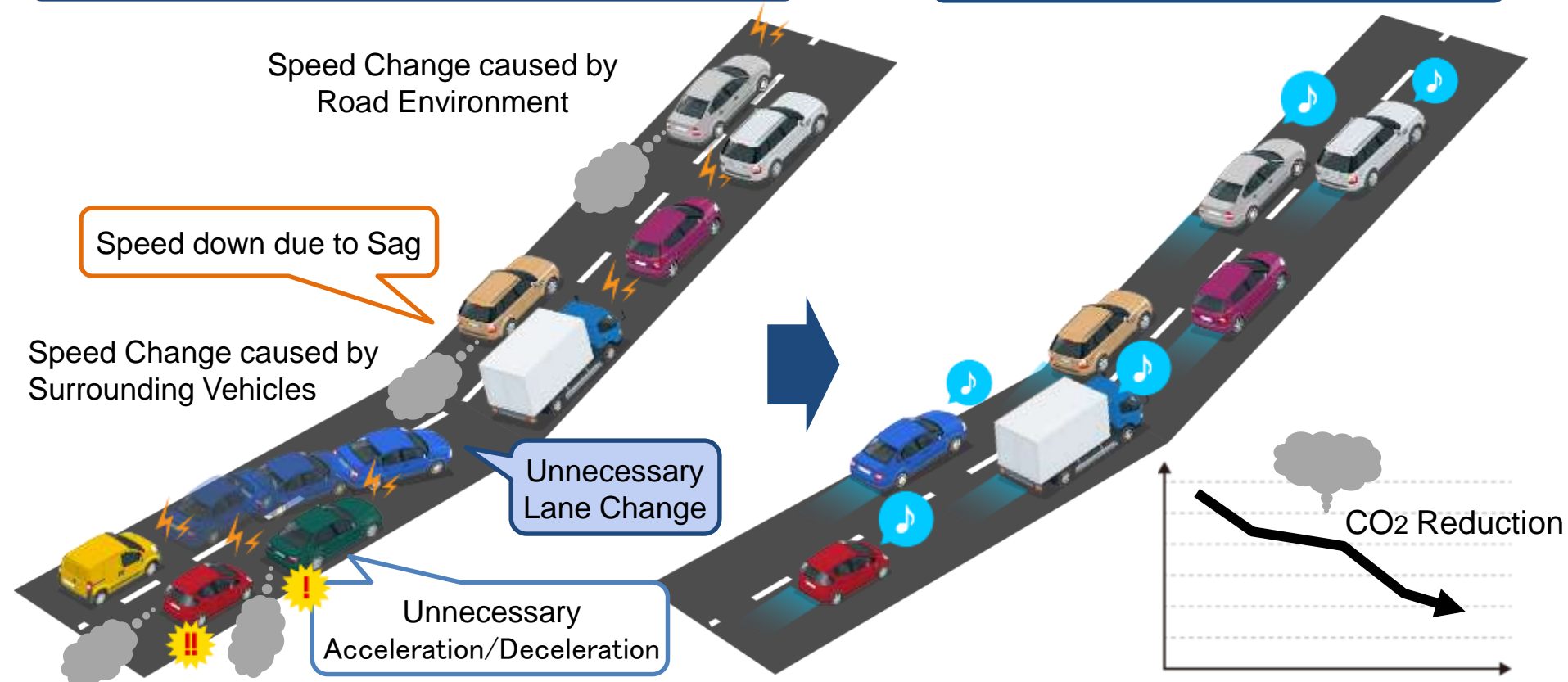**ADV：Smooth Flow**

Speed Change caused by Road Environment

Speed down due to Sag

Speed Change caused by Surrounding Vehicles

Unnecessary Lane Change

Unnecessary Acceleration/Deceleration

CO_2 Reduction

≪Purpose≫

1. To activate the R&D
2. To prove each elemental technology
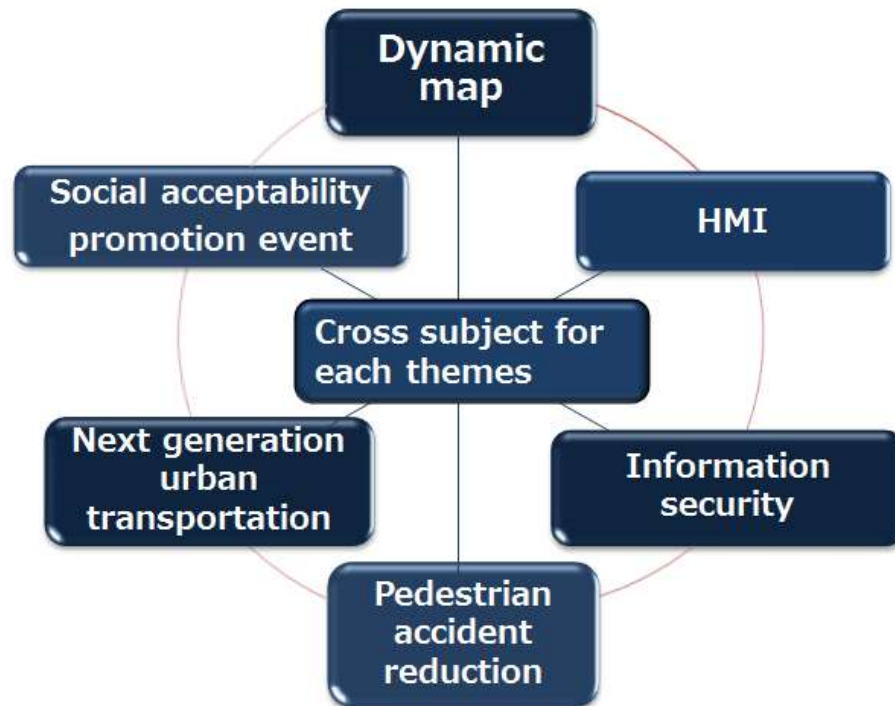3. To enhance international cooperation and harmonization
4. To Build Social acceptance

≪Participants≫

- OEM/Supplier
- University/Research organization
- Ministries, government officers
- Foreign OEM/supplier
- Journalist

≪Period≫

Autumn 2017 ～ beginning of 2019

≪Main themes≫

- Dynamic map
- Social acceptability promotion event
- HMI
- Cross subject for each themes
- Next generation urban transportation
- Information security
- Pedestrian accident reduction

≪Participants≫

Alphabetical order

《Sites》

Expressway

300 km stretch in Tokyo Area
- Joban expressway
- Tokyo Metropolitan expressway
- Tomei expressway
- Shin-Tomei expressway

Test facility

Japan Automobile Research Institute

Arterial roads

Tokyo waterfront city area

Contents

To foster social acceptance of connected and automated driving technologies, general public, students, professional drivers and fleet managers were invited.
Basic knowledge and implications were presented and discussions were moderated.

Why people move ?

1. We are not capable of photosynthesis to feed ourselves !

2. We have reasons to be at specific locations:
   to earn money to sustain ourselves   - workplace
   to take care of family members   - home
   to satisfy our curiosity, self fulfilment   - anywhere

3. We have to move between locations,
   each of which has most suitable location for its purpose.

4. Means of transportation has secondary importance, with a variety
   of preferences of individuals and situations.

5. We need to discuss automated vehicles from societal and
   humanity points of view.

How automated driving affects professional drivers ?

1. If taxi business is simply moving people from one place to another, it's already endangered by new / disruptive services.

2. Taxi operators are keen on value added services for customer expectation; assistance for the aged or physically challenged, lively conversation with those who are comfortable with it, ...

3. Safety has the highest priority for public transportation. Automated driving technologies will significantly enhance safety by assisting human drivers.

4. Bus drivers are trained to pay attention to every single passenger all the time and to properly control emergency situations.

5. Human intervention would never be replaced by computers.

What are the concerns about automated vehicles ?

1. Questions to be answered before deployment.
   Who guarantee safety ?   - product liability
   Who are blamed in case of crush ?   - criminal law
   Who pay for the damages ?   - civil law

2. Machines would never be perfect, regardless mechanical or computer controlled. There are always risks of unexpected.

3. Experts should show benefits and risks of connected and automated driving technologies with quantitative evidence.

4. The society will decide if they take risks for much larger benefits for the society. Then social framework should be designed accordingly.

Contents

In 2003, HONDA started the 'floating car data' services for their customers, which we now call 'probe car data'. Vehicle locations measured by the on-board systems using Global Navigation Satellite System (GNSS) are collected, analyzed and delivered back to the drivers as a set of traffic information. Other Japanese auto manufacturers followed. ITS Info-communications Forum in Japan conducted a survey to see how general drivers react to such services through a monthly magazine by the Japan Automobile Federation (JAF).
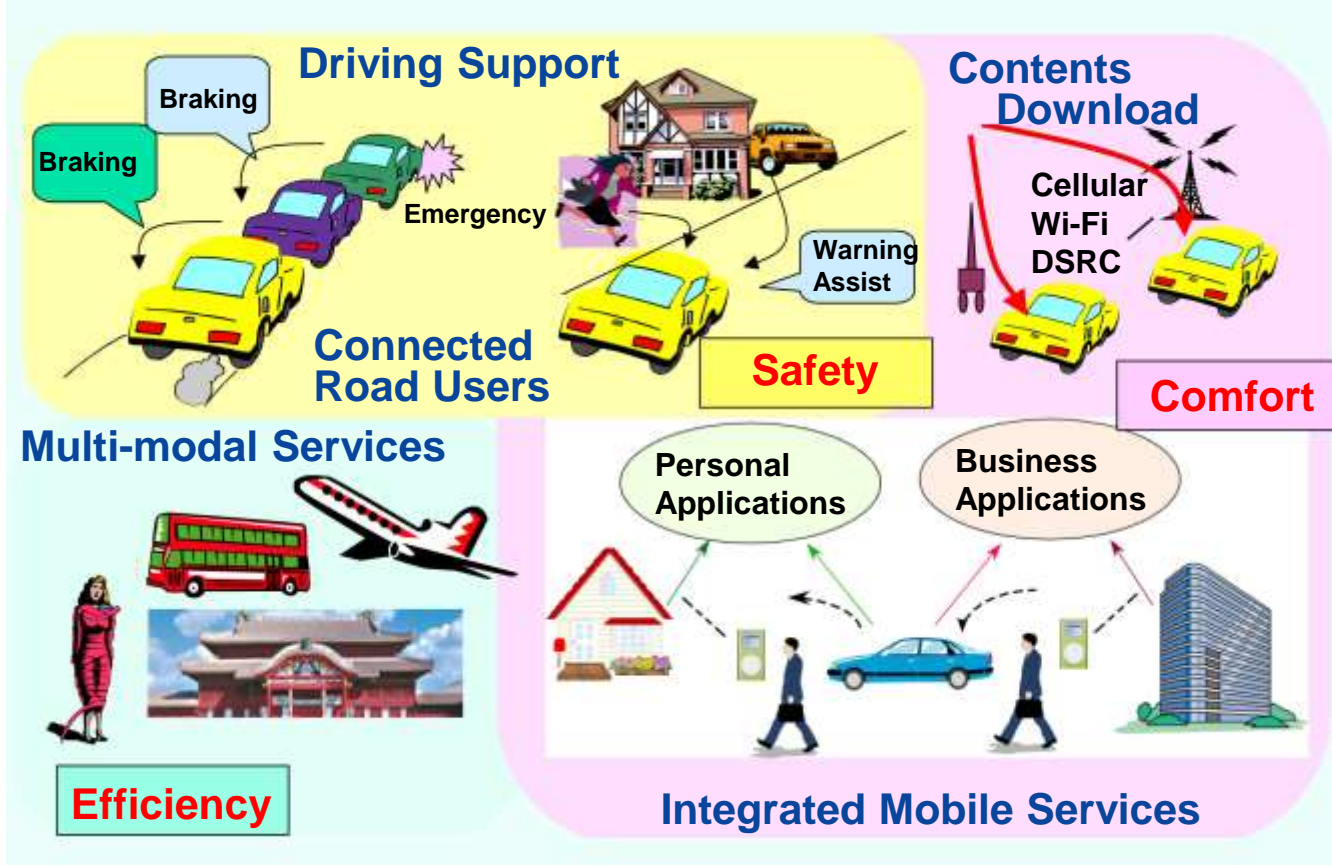
Probe Data

Central Tokyo
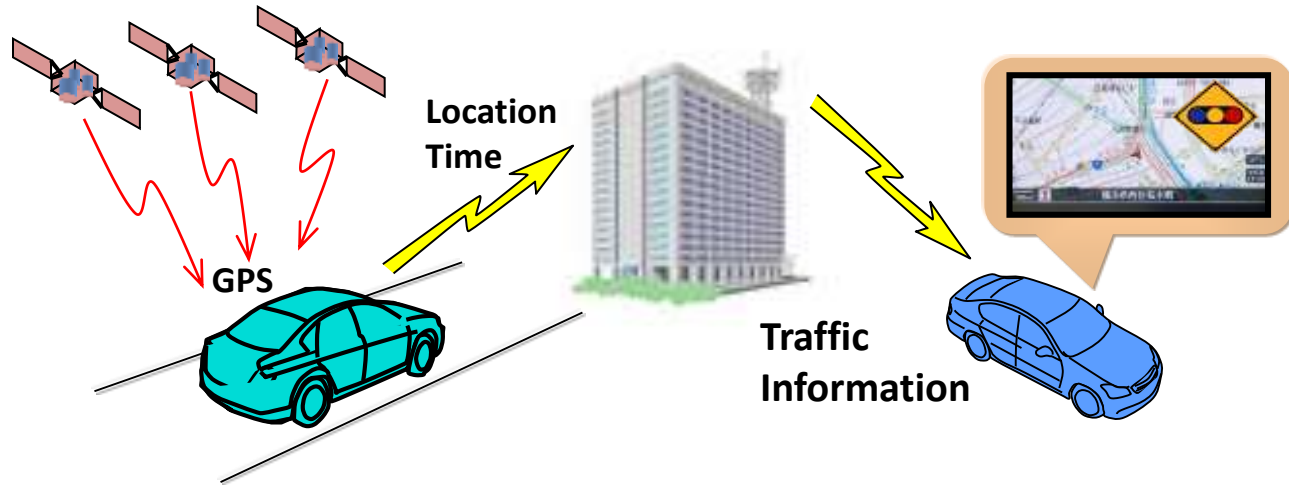
Location
Time

GPS

Traffic
Information
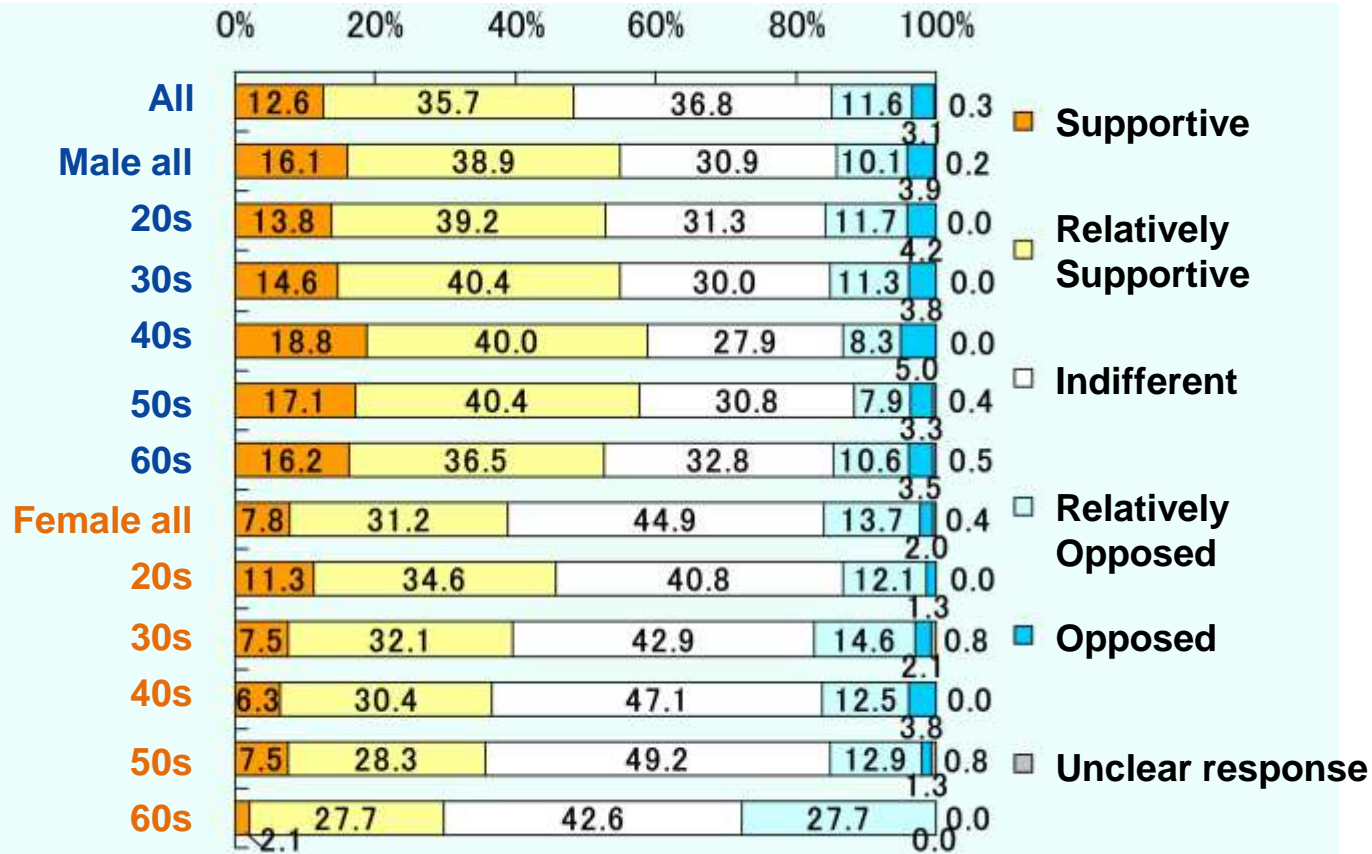
Source: Survey report by ITS Info-communications Forum, Japan, 2006

Source: Survey report by ITS Info-communications Forum, Japan, 2006

	Supportive	Opposed
Better services are expected	72.7	1.1
Privacy could be compromised	11.0	72.2
Acceptable if identity is protected	37.2	13.6
Negative to pay cost of device	9.3	39.2
Consent of installation must be properly handled	38.6	4.0
Negative to pay network charge	8.2	35.8
Skeptical about sufficient level of device penetration	7.9	21.3
Battery consumption	4.3	11.4
Other	1.3	6.3
No answer	0.6	5.1
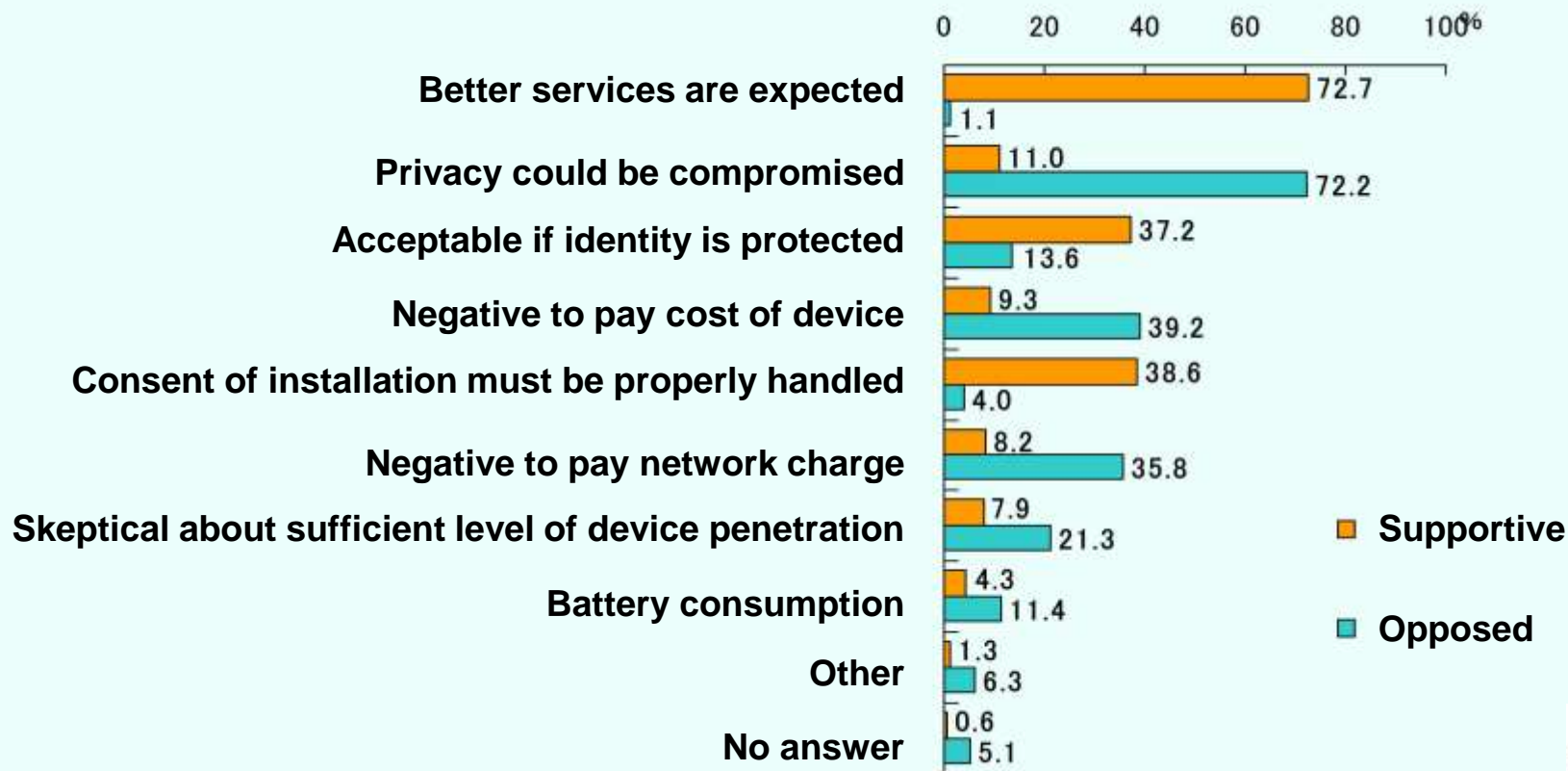
Source: Survey report by ITS Info-communications Forum, Japan, 2006

Conclusion

1. **Non-technological Challenges of social acceptance**

2. **Fundamental issues**
   - **Quantitative analyses of societal benefits**
   - **Quantitative analyses of potential risks**

3. **Consensus building how we could take risks for benefits**

Thank you